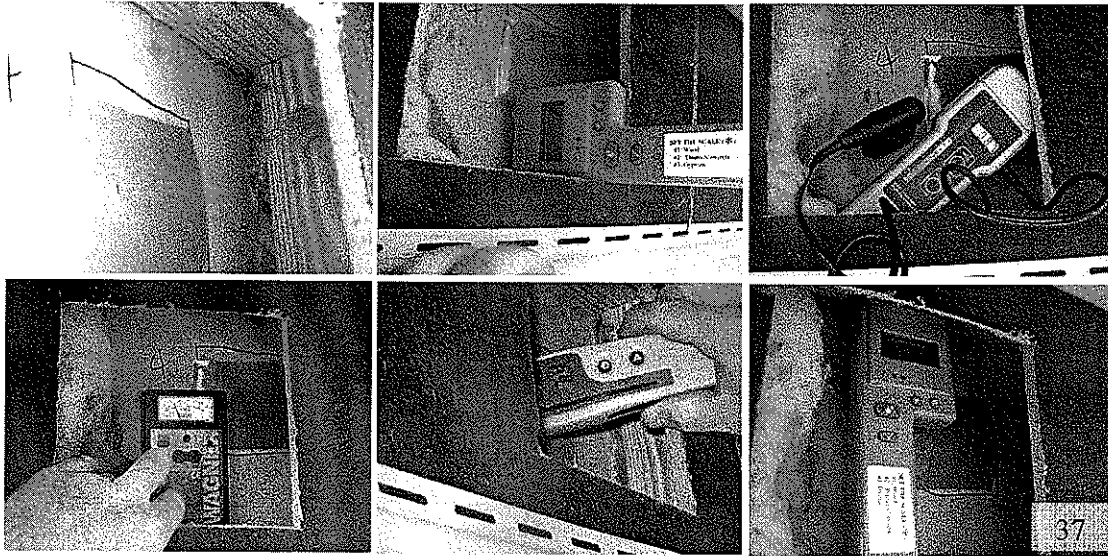
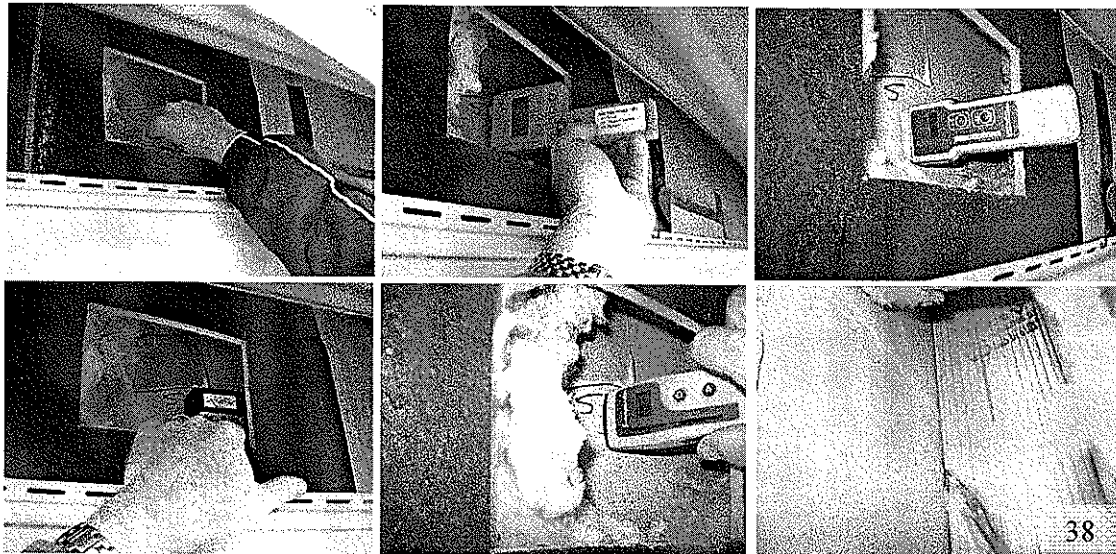


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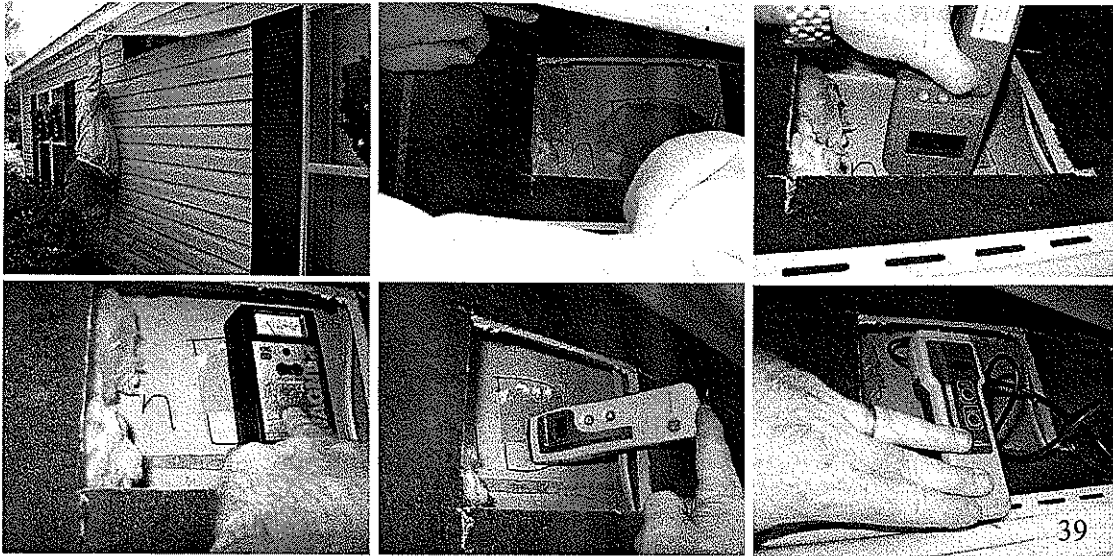
Wall Cavity Inspection Site 4



Wall Cavity Inspection Site 5



Wall Cavity Inspection Site 7



Indoor Air Quality Observations

During (MS 10-24-07) I took five air samples at the Murphy residence: 2 indoor, 1 in the crawlspace and 2 outdoor samples. Air samples were gathered using a spore-trap and pump system. Air-O-Cell cassettes were delivered to EMSL Analytical, Inc. for identification of the mold types and concentrations visual microscopy. During (MS 12-4-07), all fungal sampling work was conducted separately by LRC Indoor Testing and Research of Cary, NC, and is reported separately from this report. The lab results from the (MS 10-24-07) visit are summarized in Appendix A; highlights from Appendix A are as follows:

- The data indicates no unusual amplification inside the home compared to the current outdoor conditions.
- The crawlspace air is the apparent dominant influence over the concentrations of mold within the living area.
- It is expected that steps to reduce moisture levels in the crawlspace and to reduce air pathways into the home will result in reduced concentrations in the living area of the home.

The (HHR 5-22-06) report on this home includes several air sampling tests taken from within the wall cavity. There is no meaningful interpretation to be gained by these samples for the following reasons:

- All of the air sampling locations in the home were conducted within the wall cavity— not the air inside the living area.
- Three wall cavity samples were collected by HH. The site where the highest elevated mold concentration was identified by the (HHR 5-22-06) report was located next to the front door— which is located directly opposite of an exterior light that was not properly sealed during setup. The second site that had an elevated reading was in the master bathroom, a location that had a known plumbing/flooding event in the past, as well as moisture entry from splash into the open floor cavity behind the railroad tie. The sample sites included historic water damaged areas; results from these areas are used to represent the condition of the whole building. These known moisture management risk factors alone may explain possible local fungal amplification in the two wall cavities.
- The third site in bedroom 3 recorded only one spore.
- The initial HH report on this residence identifies this home as one with an advanced moisture/mold problem and deteriorating wall. Observation does not support this finding.
- The lab analysis on the living room sample gave a total sample count of 1,266,667 per cubic meter, indicating high-level contamination. Physical inspection of the site during (MS 10-24-07) did not reveal any visible signs of fungal activity, staining or structural damage. The physical observation for this cavity location was Condition 1—normal fungal ecology.
- There was no sample taken from air within the living area of the home. It should be expected that the living area has no amplification of mold related to the wall cavity.

- Finally, it is known that bulk, surface, and within-wall cavity measurement for molds cannot be used to assess occupant exposure.²⁹

The (HHR 10-26-07) specifically says that sampling locations were “randomly selected.” Randomly selected is a term of art in research in an attempt to limit bias. There is no discussion of how samples were randomly selected. In fact, an evaluation of all (HHR 5-22-06) and (HHR 10-26-07) sample locations suggests that sampling sites were not random.

²⁹ The medical effects of mold exposure, Bush RK, Portnoy JM, Saxon A, Terr AI, Wood RA, The Journal of Allergy and Clinical Immunology- 2006 02 (Vol. 117, Issue 2) Conclusions: Air Sampling of both indoor and outdoor air for mold...can be useful in certain clinical conditions, but it has many shortcomings. Bulk, surface, and within-wall cavity measurement for molds ... cannot be used to assess (occupant) exposure.

Appendix A - Air Sampling Analysis from the Murphy Home Montgomery, AL

**Francis Conlin, PE, CMR
Samples gathered on October 24, 2007**

Air samples were gathered using a spore-trap and pump system at several locations in and around the Murphy home on October 24, 2007. Air-O-Cell cassettes were delivered to EMSL Analytical, Inc for identification of the mold types and concentrations observed by visual microscopy.

Summary

- The data indicates no unusual amplification inside the home compared to the current outdoor conditions.
- The crawlspace air is the apparent dominant influence over the concentrations of mold within the living area.
- It is expected that steps to reduce moisture levels in the crawlspace and to reduce air pathways into the home will result in reduced concentrations in the living area of the home.

Average Outdoor vs Indoor Air by Genera

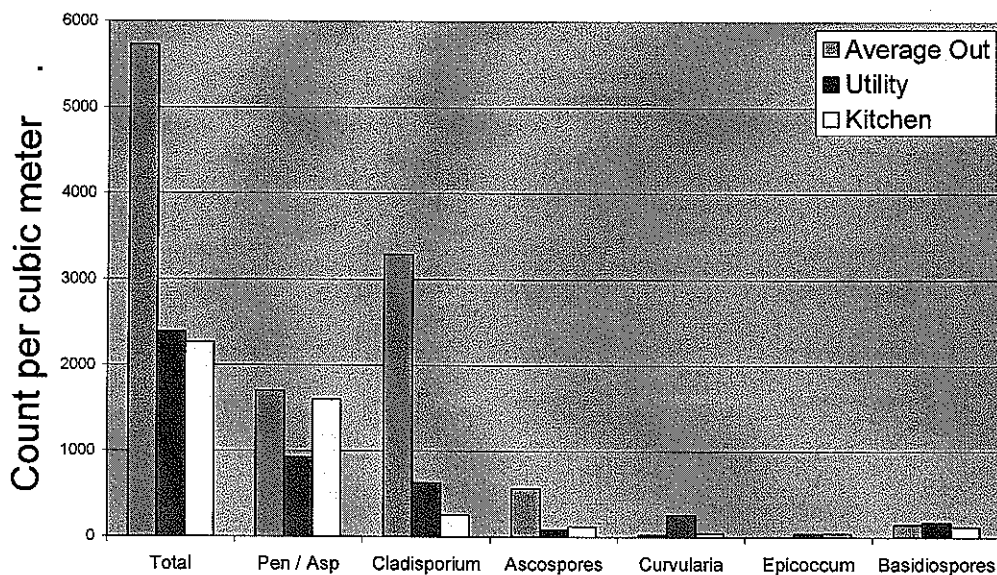


Figure A1. Generally the average outdoor air contains more mold spores than does the inside air - both by total count and by mold type.* Comparing outside to inside mold concentrations is a standard method to evaluate whether unusual amplification of mold is present. This data indicates no unusual amplification.

There are no specific standards for mold levels. Outdoor air could be the sole source of mold found in this home, particularly because the air samples reflects only one point in time and is an average of only 2 outdoor samples. However, the indoor levels do not compare closely with the outdoor concentrations.

**Where very small samples were gathered curvularia etc, the samples have less statistical validity – regardless these are small numbers.*

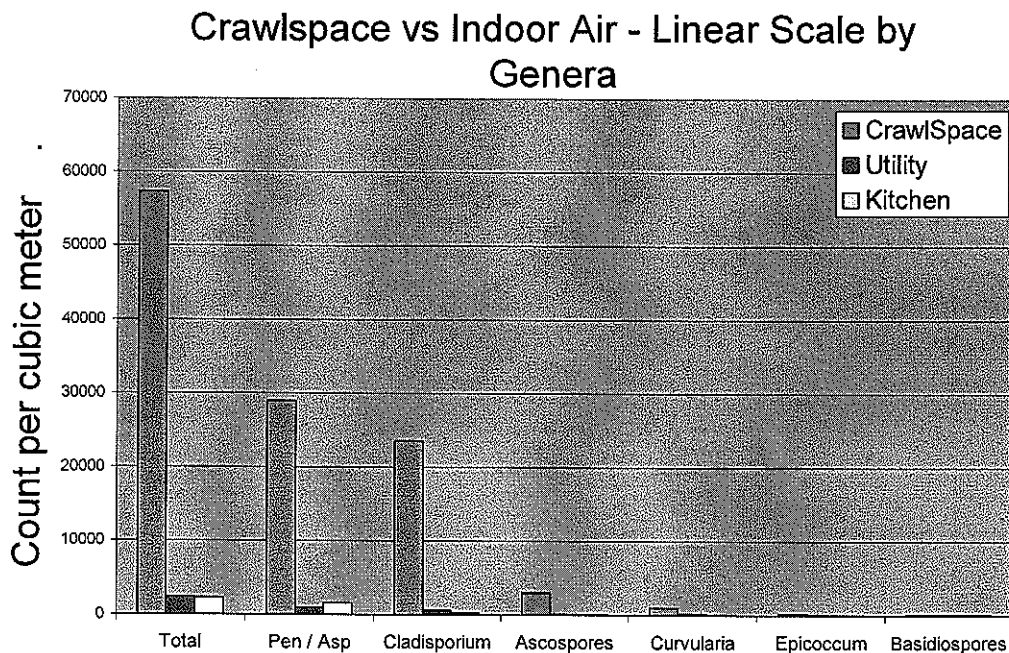


Figure A2. This home interacts with a second outdoor environment from the crawlspace underneath the home. Research shows that some portion of crawlspace air will enter the living area, and if the crawlspace air contains mold spores, these will tag along and enter the living area as well.

Generally, the crawlspace air contains considerably more mold spores than does the inside air. The crawlspace has 23 times higher total mold spore concentration than does the indoor air.

The linear scale used in this chart makes it difficult to compare the relationship between the crawlspace and indoor spore levels because the crawlspace levels are orders of magnitude higher than the indoor air concentrations.

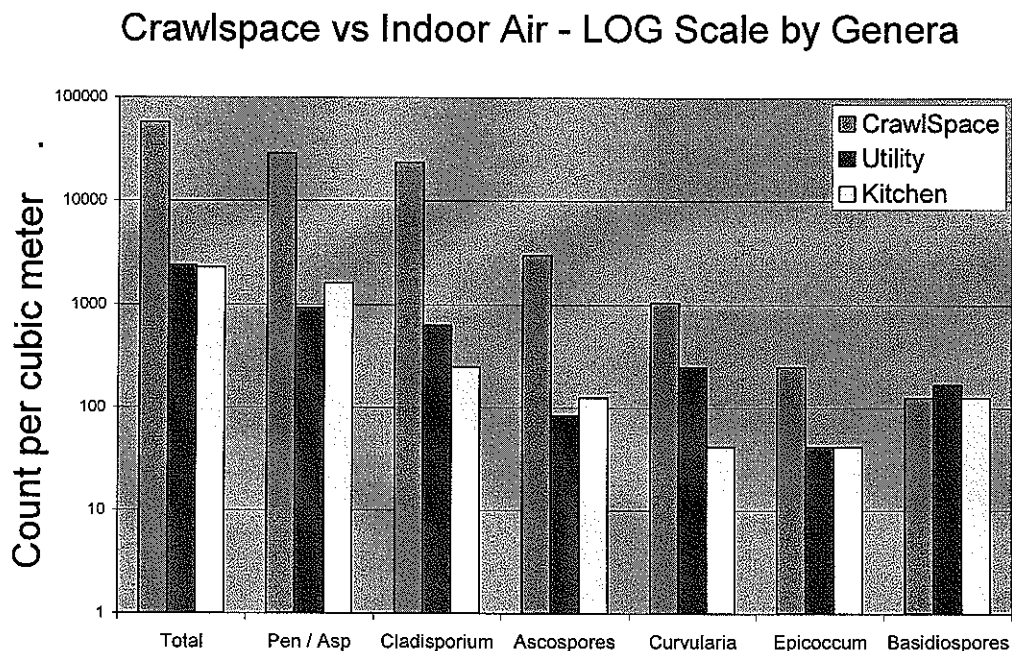


Figure A3. This graph uses a Logarithmic scale to make it easier to compare the relationship between the crawlspace and indoor spore levels. This chart represents the same data as in Figure 2, but the y-axis has been changed to a Log scale.

It is easy to see that there is a strong relationship between the population of molds between the crawlspace and the indoor air; both for the total mold count and by mold type concentrations. This finding strongly suggests that the crawlspace is the dominant influence over the concentrations of molds within the living area.

It is expected that steps to reduce mold concentration in the crawlspace and to reduce air pathways into the home will result in reduced concentrations in the living area of the home.

mSolve, Building Science Services



EMSL Analytical, Inc.

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705 Watts Street
Durham, NC 27701

EMSL Order: 020706111
Customer ID: MSOL78
Received: 10/30/07
Analyzed: 10/30/07
Report Date: 10/31/07

Proj: Fleetwood/Murphy

Air-O-CellTM Cassette Analysis of Fungal Spores & Other Airborne Particulates by Optical Microscopy (EMSL Method M001)

Lab Sample Number:	020706111-0001	020706111-0002	020706111-0003	020706111-0004	020706111-0005
Client Sample ID:	13115208	13115085	13115215	13115099	13115143
Volume (L):	75	75	75	75	75
Sample Location:	Kitchen	Utility	Out-Back Porch	Out-Front Porch	Crawl Space
Spore Types	Count/m ³	Count/m ³	Count/m ³	Count/m ³	Count/m ³
Agrocybe/Coprinus	-	-	-	-	-
Alternaria	-	42	-	-	84
Ascospores	126	84	588	546	2980
Aspergillus/Penicillium	1600	924	3320	84	29000
Basidiospores	126	168	84	210	126
Bipolaris	-	-	-	-	-
Chaetomium	-	168	-	-	-
Cladosporium	252	630	1470	5120	23600
Curvularia	42	252	42	-	1050
Epicoccum	42	42	-	-	252
Fusarium	-	-	-	-	-
Ganoderma	-	-	-	-	-
Myxomycete	-	84	-	-	42
Paecilomyces	-	-	-	-	-
Rust	-	-	-	-	-
Scopulariopsis	-	-	-	-	-
Stachybotrys	-	-	-	-	-
Torula	-	-	-	-	42
Ulocladium	-	-	-	-	-
Unidentifiable Spores	-	-	-	-	-
Zygomycetes	-	-	-	-	-
Spegazzinia	84	-	-	-	42
Tetraploa	-	-	-	-	42
Total Fungi	2270	2390	5500	5960	57300
Fibrous Particulate	84	42	42	42	420
Hyphal Fragment	84	84	-	-	1470
Insect Fragment	-	-	-	-	42
Pollen	42	-	42	-	42
Analytical Sensitivity	42	42	42	42	42
Skin Fragments (1-4)	2	1	1	1	1
Background (1-5)	2	2	2	2	4

No discernable field blank was submitted with this group of samples.

High levels of background particulate can obscure spores and other particulates leading to underestimation. Background levels of 5 indicate an overloading of background particulates, prohibiting accurate detection and quantification. Present = Spores detected on overloaded samples. The detection limit is equal to one fungal spore, structure, pollen, fiber particle or insect fragment. ** Denotes particles found at 300X. This report relates only to the samples reported and may not be reproduced, except in full, without written approval by EMSL. Results have not been adjusted for field or laboratory blank unless otherwise noted. Samples received in good condition unless otherwise noted.

Lee Plumley, Laboratory Manager
or Other Approved Signatory

Page 1 of 1

For information on the fungi listed in this report please visit the Resources section at: www.emsl.com

SP/2.7.1.1A

Figure A4. Air sample data collected from the Murphy Home, Montgomery, AL

Privileged and Confidential - Investigated at the Request of, and Under the Direction of Counsel

Appendix B - Comments on Healthy Homes' expert report

Subject Report: "Inspection of The Fleetwood Factory Built Home Belonging to the Murphy family)" By Bobby Parks of Healthy Homes of Louisiana, LLC, for Lance Gould of Beasley, Allen, Crow, Methinks, Portis & Miles, P.C, Montgomery, AL 36104
No report date, site visit indicated as 5-22-2006 (HHR 5-22-06).

by Francis Conlin, mSolve Building Science Services, Professional Engineer, IAQA Certified
Mold Remediator and Building Science Specialist

Summary:

The claims in the subject report cannot be supported by the evidence found on site. The apparent hypothesis that: "the presence of an interior vapor retarder is the root cause of ubiquitous moisture problems in the exterior walls of manufactured housing generally and specifically in this house" is not demonstrated. The report lacks rigor and objectivity and thus has no scientific merit. For example the (HHR 5-22-06) report omits key elements of moisture dynamics resulting in an incomplete evaluation of the home -- including:

- Obvious visible leak sites through the exterior wall covering were not reported
- Owner installed perimeter rail road ties that direct rain water against the exposed exterior walls and into the crawl space was not reported
- A major past flooding event in the master bathroom that caused wall wetting was not reported
- Protocols used to gather wall samples lack an appropriate control to test the apparent hypothesis
- Improper maintenance of the air conditioner is not accounted for
- A chronically wet crawlspace with a disconnected dryer vent discharge are completely ignored

The report does not demonstrate a grasp of the engineering and technical analysis required to understand the complex building performance concepts involved in moisture dynamics. Analytical methods applied to implicate this home would implicate nearly every home where they were applied.

Report Issue 1 (Pg. 1, Paragraph 2)

Summary: These issues included; 1) Elevated moisture content within the perimeter walls causing structural softening and deflections. 2) Possible fungal-like growth within the home.

Response 1

1) Since the (HHR 5-22-06) was completed, a total of 8 exterior wall cavity sites have been investigated by invasive inspection during the (MS 10-24-07) and (HHR 10-26-07) inspections. These observations revealed confirmed multiple observations of IICRC S-520 Condition 1 were observed except in areas of known historic flooding in the master bathroom. Master bathroom wall observations are attributed to past and ongoing localized bulk water intrusion conditions and not to the plaintiff's allegation of condensation wetting caused by the use of vinyl wallboard. Specifically the bulk water intrusion conditions that are ignored by the plaintiff are:

- A major past flooding event in the master bathroom that caused wall wetting was not reported
- Owner installed perimeter railroad ties that direct rain water against the exposed exterior walls and into the crawl space were not reported
- A chronically wet crawlspace with a disconnected dryer vent discharge was completely ignored

2) It is an accepted fact that exterior walls in all buildings experience some increase in moisture content during periods of elevated relative humidity (such as are experienced in the summer months),³⁰ but that they will decrease in moisture content when dryer weather occurs.³¹

3) Wall samples removed during (MS 12-4-07) were sent to a certified materials test lab to conduct standardized structural testing (ASTM C437). Tests were conducted for flexural strength, core hardness and nail pull resistance, in each test the exterior gypsum wallboard far exceeded the minimum performance outlined in the Standard Specification for Gypsum Board (ASTM C 1396 – 06a).³²

4) Possible fungal growth is alleged only in very isolated areas within the wall cavity. If the wall design itself were the root cause of moisture accumulation, then it follows that large wall areas should experience elevated moisture levels - this is not presented or observed. Furthermore, it is known that bulk, surface, and within-the-wall cavity measurement for molds cannot be used to assess occupant exposure.³³ No sampling of the indoor air was documented by the Plaintiff—indoor air sampling is the standard and accepted method used to identify if elevated levels of mold are present within the living area and is of concern.³⁴

Report Issue 2 (Pg. 1, Paragraph 4)

Improper application of the wall construction standards. Does not concur with basic engineering practices or meet the prescriptive standards which requires *"home producers in assuring that homes built and sited in humid and fringe climates are durable and free of moisture-related problems."* *24 CFR Part 3280 [Docket No. FR-4578-F-02] / 3280.504(b)

³⁰ Building Science for Building Enclosures, John Straube and Eric Burnett, Building Science Press, Inc. Westford, Massachusetts, 2005 Section 8.3.2 Vapor storage mechanisms page 319 paragraph 1: "All hygroscopic materials attract and adsorb water vapor until they reach equilibrium with the surrounding air...The amount of moisture stored by adsorption is shown on figure 8.17... [to rise as a function of temperature and humidity levels i.e. summertime conditions.]

³¹ Letter dated July 27 from Robert Wessel Ph.D. of the Gypsum Association, "Gypsum has the unique ability to adsorb (and absorb) water and soften yet it regains its original hardness once it dries out."

³² Standard Specification for Gypsum Board ASTM C1396: This specification covers Gypsum wallboard, designed for use on walls, ceilings, or partitions and that affords a surface suitable to receive decoration; and pre-decorated gypsum board, designed for use as the finished surfacing for walls, ceilings, or partitions.

³³ The medical effects of mold exposure, Bush RK, Portnoy JM, Saxon A, Terr AI, Wood RA, The Journal of Allergy and Clinical Immunology- 2006 02 (Vol. 117, Issue 2) Conclusions: Air Sampling of both indoor and outdoor air for mold...can be useful in certain clinical conditions, but it has many shortcomings. Bulk, surface, and within-wall cavity measurement for molds ... cannot be used to assess (occupant) exposure.

³⁴ Power Bioaerosol Sampling J. Neville et. al. American Industrial Hygiene Association • 2700 Prosperity Ave., Suite 250 • Fairfax, VA 22031 Podium 113. Bioaerosol Sampling I—Traditional Approaches May 30, 2004. "Bioaerosol sampling is performed to estimate microbial air concentrations in suspected building areas. Since safe bioaerosol exposure levels have not been established yet, indoor levels are compared with outdoor levels as the background control."

Response 2

The parenthetical language in the Healthy Homes Report is not part of the wall construction standards found in HUD 24 CFR Part 3280 Manufactured Home Construction and Safety Standards (MHCSS). Instead, this language is part of a larger discussion of a waiver to provide an additional prescriptive wall construction option to the MHCSS.³⁵ This waiver has been in formal discussion since at least 2000, but has only been promulgated in a usable form in 2005 and went into effect on May 30, 2006.³⁶ This home was constructed in September 2003 long before the discussion was documented in the Federal Register regarding these matters.

HUD has offered a clear interpretation that the HH claim that HUD Code section 3280.303 (b) should be applied to manufacturers' practices regarding placement of vapor retarder misrepresents HUD enforcement policy. To clarify this issue a letter was written from the Associate Deputy Assistant Secretary for Regulatory Affairs and Manufactured Housing that states: "Consistent with basic principals of administrative law, it is HUD's practice to hold manufacturers accountable for compliance with the standard that most specifically applies to a particular aspect of construction. Accordingly, there is no case in which HUD has applied 3280.303(b) to a manufacturer that has complied with 3280.504(b)."³⁷

The State of Alabama has adopted a similar position as the new HUD waiver with regards to regulating use of vapor retarders in site-built wall construction: "Vapor retarders are required on the wall interior by the site-built code, but an exemption to the requirement is made for hot, humid zones."³⁸

Specific language in the HUD-Code wall construction standards is met in this home. Basic engineering practice requires that specific codes be recognized and be followed.

Report Issue 3 (Pg. 2, Paragraph 1)

Conclusion: previously stated problem has created extremely moist conditions within the perimeter walls. This moisture has caused structural deterioration and created fungal growth within the wall structure. Due to this inappropriate wall design being utilized within the geographical location of this home, the conditions will only worsen with time and eventually render the home unfit for its intended purpose. Remediation of this home should be performed by licensed professionals in order to preserve structural integrity and prevent any further occupant exposure.

Response 3

³⁵ Department Of Housing And Urban Development 24 CFR Part 3280 Manufactured Home Construction and Safety Standards.

³⁶ Federal Register / Vol. 70, No. 229 / Wednesday, November 30, 2005 / Rules and Regulations, Department Of Housing And Urban Development 24 CFR Part 3280 Manufactured Home Construction and Safety Standards AGENCY: Office of the Assistant Secretary for Housing—Federal Housing Commissioner, HUD. ACTION: Final rule. Page 72046-72047, Section 3280.504 Condensation control and installation of vapor retarders.

³⁷ Letter dated January 19, 2007 from William W. Matchneer III, Associate Deputy Assistant Secretary for Regulatory Affairs and Manufactured Housing to Brian D. Cooney Vice President, Government Affairs of the Manufactured Housing Institute. "... there is no case in which HUD has applied 3280.303(b) to a manufacturer that has complied with 3280.504(b)." etc.

³⁸ Alabama voluntarily adopted the MEC/IECC building code for site-built homes. The 2000 IECC references vapor retarders in Section 501.1.1; and states that "Vapor retarders must be installed in all non-vented framed ceilings, walls and floors..." but goes on to stipulate and Exception: "Vapor barriers are not required" in zones identified as hot and humid – vapor barriers may be used; the IECC stipulates only that vapor barriers are not required in hot, humid climates. Alabama updated its code in 2004 where the vapor retarder requirement is not mentioned.

The HH report omits consideration of conditions at the home that are actually responsible for moisture problems:

- There is no evidence presented of any observed or measured excess wall moisture,
- There is no evidence presented of any observed structural deterioration.
- Major moisture issues in buildings most often are identified in the first 2 years of operation. This is a 4-year old home and there is no indication that "conditions will only worsen"; in fact, by addressing maintenance deficiencies identified in this report, durability conditions will improve.
- A careful survey of the home finds evidence that water has been splashing into an opened floor cavity near an on-site installed faucet near the master bathroom wall.
- A careful survey of the home finds overwhelming visual evidence that water has a visible history of running underneath and collecting into the crawlspace. The crawlspace has saturated soil. Exacerbating the situation is the fact that the dryer exhaust discharges directly into the crawl space.

The Healthy Homes report is implying that the presence of a vapor retarder on the inside is causing condensation. Vapor retarders and barriers do not cause condensation. Condensation is a function of only two elements: 1) Surface Temperature and 2) Dew point of ambient air at that surface.³⁹ If any moisture problems exist in a wall cavity this is a result primarily of moisture gaining entry at isolated spots in the wall construction and not to the presence of a vapor retarding surface.

If the wall design alone were the root cause of moisture accumulation, than it follows that the entire wall should experience softness and other indications of moisture - this is not the case. These findings should suggest to a thorough investigator to look for other more local causes of elevated mold levels.

The Healthy Homes report characterized the walls as having extremely moist conditions - the presence of "extremely moist wall conditions" has not been established. All exterior walls (including residential site constructed homes, commercial buildings etc.) gain moisture during summer months in hot, humid climates. The amount of water gained in a wall cavity is a factor of many elements including: indoor thermostat set point, wind exposure, leakage through the envelope, ambient air conditions, HVAC maintenance, pressure imbalances caused by duct leakage, holes in the bottom plastic and use of appliances such as clothes dryers and bath fans. Moisture in a wall is a dynamic condition - walls gain and expel moisture on a daily and annual cycle. Gaining moisture is not the same as failing, the Gypsum Association makes it clear that 1) A moisture meter is an inaccurate and inappropriate method to quantify moisture content in gypsum board materials, and that 2) Gypsum has the unique ability to adsorb and absorb water vapor and soften, but then to regain its original hardness once the moisture content lowers.⁴⁰

Should repairs be indicated to several isolated wall areas, these repairs should focus on verified problem areas of the wall, the source of moisture entry to be remedied and the replacement of any damaged wall material. A clearance test of air inside the living area may be appropriate at this time, but air samples from inside a wall cavity are meaningless to assess risk to occupants. As a

³⁹ ASHRAE Fundamentals 2005 Chapter 23.1 Simplified Hygrothermal Design Calculations and Analyses Surface Condensation

⁴⁰ Letter dated July 27 from Robert Wessel Ph.D. of the Gypsum Association. Dr. Wessel is a member of the ASTM Committee C11 on Gypsum and on the ASTM C11 Task force that is studying ways to develop a standard to provide guidance on the use of moisture meters to evaluate gypsum board.

Certified Mold Remediator and Professional Engineer who has specified and observed similar wall repairs, I can attest that there is no indication that such an endeavor to any possibly damaged walls in this house will be an extensive or expensive repair.

Report Issue 4 (Pg 3, Paragraph 1)

Improper application... etc. Repeat of Report Issue 2

Response 4

See Response 2

Report Issue 5 (Pg 3, Figure 1 caption)

Figure 1 3280.504(b)(1) which is the wall structure utilized in the construction of the this home. And Figure 2 3280.504(b)(2) is a wall standard which would be suitable...

Response 5

Both the Figure 1 and Figure 2 illustrations demonstrate the alleged wall cavity condensation effect by showing an outside dew point temperature of 78 degrees. The use of 78 degrees represents bias and a lack of objectivity by the HH expert. A review of NOAA weather data for Montgomery, AL for the last four years (2007, 2006, 2005 and 2004) shows that there were no days when the mean daily dew point temperature reached 78 degrees, maximum dew point of 78 was reached only 3 times in the last 2 years for only a portion of the day.

Figure 2 incorrectly recommends that a 3280.504(b)(2) wall without an interior vapor retarder should have been utilized for this home. This home is intended for HUD Thermal Zone III, regardless there is no record of this wall design being built successfully in HUD Thermal Zone I.

Report Issue 6 (Pg 3, Paragraph 2)

This wall construction offers little resistance to the moisture laden outdoor air found within the "Hot Humid"/"Fringe" climates, yet requires an almost completely restrictive barrier on the cold indoor side...

Response 6

As designed and constructed the wall cavity provides a significant air barrier at the exterior sheathing level. This air barrier offers significant resistance to the introduction of moisture laden outdoor air into the wall cavity. Moisture control handbook by Joe Lstiburek states "Concealed condensation can be controlled by reducing the entry of moisture into the wall cavities or by elevating the temperature of the first condensing surface."⁴¹

The Healthy Home's apparent hypothesis for explaining moisture accumulation in wall cavities is incomplete, oversimplified and demonstrates bias. The argument presented directs responsibility only at the vapor permeance of the inside wall covering and specifically at assumed presence of vinyl wall paper. The phenomena of moisture accumulation dynamics in wall cavities in the

⁴¹ Moisture Control Handbook: Principles and Practices for Residential and Small Commercial Buildings. By Joseph Lstiburek and John Carmody. 1994. John Wiley & Sons, Chapter 1- Mold, Mildew and Condensation, Pg 12 Concealed Condensation.

summertime are complex. To explain the phenomena, an acceptable hypothesis needs to address all moisture dynamics involved, and specifically how excess moisture is entering the cavities, and the correlation of interior space temperatures with cavity condensation. Vinyl wallpaper is a small part of the moisture dynamics of walls; bulk water and moist air infiltration are by far more important factors causing elevated moisture levels as reported.

Report Issue 7 (Pg. 4, Paragraph 2)

This [restrictive barrier] serves to trap the moisture within the wall cavity area and cause "cold in summer" side of the wall to condensate much like a "glass of ice tea in the summertime".

Response 7

The Healthy Homes report is confusing the physics that govern condensation. Response 4, paragraph 2 is repeated. Vapor retarders and barriers do not cause condensation. Condensation is a function of only two elements: 1) Surface Temperature and 2) Dew point of ambient air at that surface.⁴² If any moisture problems exist in a wall cavity this is a result primarily of moisture gaining entry at isolated spots in the wall construction and not to the presence of a vapor retarding surface.

Describing that condensation occurs in the wall cavities like "a glass of ice tea" is a gross exaggeration under any circumstance. On the rare days that condensation is even possible, outside air entry is significantly limited through a combination of a leak in the air barrier and a driving force that brings the outside air into the wall cavity. Even if all of these conditions are present, the wall cavity is made up of hygroscopic materials that absorb and adsorb moisture and provide a "hygric buffer" against condensation⁴³ – this is completely different than a cold glass of tea that cannot absorb and store moisture. A glass of ice tea is also close to 32°F and will express robust condensation when exposed to outdoor summer dew points of 75°F – the air continues to loose moisture as it drops almost 30°F. Whereas, if we use a more realistic temperature as is found in the home, such robust condensation will not occur. The temperature of air near a tea glass at 70°F will drop at most only a few degrees and will result in very little, if any, liquid condensation. Certainly a wall cavity will never appear "like a glass of ice tea."

The HH report bias is most extreme when the author contends that moisture will condense in wall cavities much like a "glass of ice tea in the summertime". This level of water droplet formation in the wall cavity would lead to rapid and widespread structural deterioration of the wall system within weeks. There is no substantiated evidence of any structural deterioration in this home that is over 4-years old.

Report Issue 8 (Pg. 3, Paragraph 3)

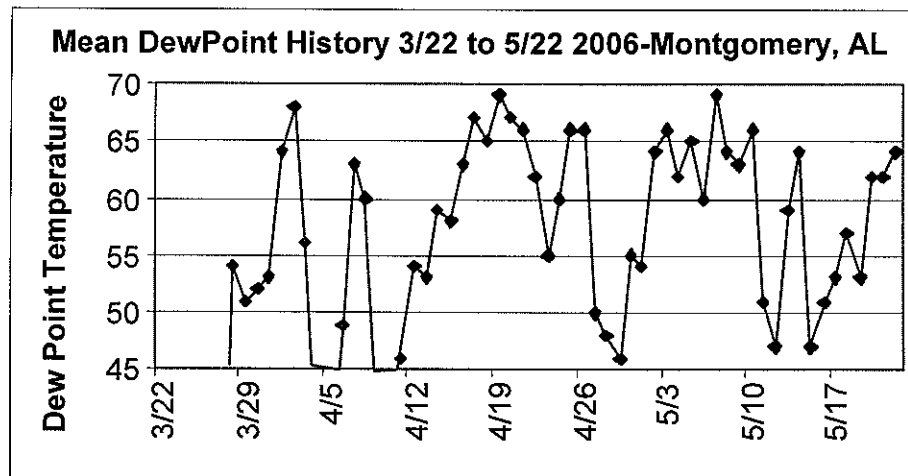
This prolonged exposure to moisture can and has caused premature deterioration of the wall structure. Typical moisture content within the interior partition walls of this home were in the 10% -12% mc range. Consistent readings within the Murphy's perimeter gypsum walls were in the 25%-40% range.

⁴² ASHRAE Fundamentals 2005 Chapter 23.1 Simplified Hygrothermal Design Calculations and Analyses Surface Condensation

⁴³ Building Science for Building Enclosures by John Straube and Eric Burnett — 2005 Chapter 8.3 "Storage provides the buffer in time between the deposition and removal of moisture." Researchers at ORNL call this the hygric buffer.

Response 8

The outdoor dew point conditions prior to the (HHR 5-22-06) inspection were consistently too dry to cause any alleged wall cavity condensation wetting. The following figure shows that for two months before the (HHR 5-22-06) inspection, the mean daily dew point only reached 69F degrees on 2 occasions and the average daily dew point was only 55F degrees. As long as the home is warmer than the outside air condensation is impossible under these conditions. Given the weather history, wall moisture readings of 25% - 40% relative moisture content is not possible.



The author cites an unsubstantiated claim of a “premature deterioration” of the wall structure. A mild softening exists in any wall exposed to humid environments; gypsum (paper or vinyl covered) will experience a mild and temporary change in properties that is anticipated and typically provides satisfactory performance. The author also misrepresents measurements of moisture content of the gypsum; the Gypsum Association clearly states that moisture meters do not provide accurate moisture content reading for the gypsum board. Moisture meters can only provide a non-scalar value useful only to rank order the degree of wetness, and that a reading of 20% on a moisture meter does not imply that a sample has twice the moisture of a sample reading of 10%. The Gypsum Association makes it clear that 1) Gypsum has the unique ability to adsorb and absorb water vapor and soften, but then to regain its original hardness once its moisture content is lowered, and that 2) A moisture meter is an inaccurate and inappropriate method to quantify the moisture content in gypsum board materials.⁴⁴ Moisture level in any wall is a dynamic condition - walls gain and expel moisture on a daily and annual cycle. By itself, an increase in moisture content for materials located on exterior walls is expected, and is not an unusual situation.

Other than this statement, the HH report provides no documentation whatsoever to support the allegation that “moisture readings in the perimeter walls were 25% - 40%”. The report provides no photographs, diagrams, methodology or observed data on the measurement of wall moisture.

⁴⁴ Letter dated July 27 from Robert Wessel Ph.D. of the Gypsum Association

Report Issue 9 (Pg. 4-5)

Conventional and infrared photos (Figures 3-9) demonstrating alleged areas of “air” and “air/heat” infiltration

Response 9

The Healthy Homes report shows 3 infrared thermal images accompanied by standard photos of the same surfaces. The Figure 7 caption refers to “air/heat infiltration” The thermal images are misinterpreted and the reporting is again biased.

Thermal imaging shows temperature surface temperature differences only. There is no way to tell by looking just at these thermal images whether there is any air infiltration taking place behind the mass surfaces and within the wall cavities. The red/yellow areas that are visible could have been caused solely by heat conduction due to insulation gap and compression.

The use of the term “air/heat infiltration” in the photo caption demonstrates that HH does not understand the basic elements of heat transfer. Heat is transported by conduction, convection and radiation. In these photos all surfaces shown have sufficient thermal mass such that the only reliable observations that could be made pertain to heat conduction. Thus, except for an observed hole behind the master bathroom light, these images provide no defensible evidence of identified air infiltration in the perimeter walls.

Photo figures begin on page 4: These pictures are not referenced in the text of the HH report. Figure 5 is a close up picture showing alleged “extensive fungal growth. The location of this photograph is not referenced, but is presumably within the master bathroom wall and which is the result of plumbing failure and subsequent flooding.

Infrared images taken outside the guidelines provided ASTM inspection protocol can be misinterpreted. The inaccurate and biased conclusions HH makes on these photos demonstrates that Mr. Parks is not qualified to interpret infrared thermal imaging.

Infrared cameras are typically set up to maximize the range of color used illustrate temperature differences. The actual temperature differences in IR images are typically not as dramatic as the photos suggest. Most of these IR images reflect thermal bridging and possibly reflected IR radiation. This is a normal and expected image seen in infrared photography taken during the daylight hours when sunlight can impact the images and confuse interpretation.

Report Issue 10 (Pg. 6, Paragraph 1)

Slight pressure imbalance caused by an improperly connected ventilation system
Sec.3280.103(b)(3)

Also Paragraph 3: Without this type of ventilation system, the home will experience a “negative pressure” event with even the lightest amount of duct leakage.

Also Paragraph 4: The ventilation system within the Murphy home has been installed in an inappropriate manor, which hinders its effectiveness.

Response 10

As can readily be seen in the Figure 12 photo, this home has the ventilation system that the HH prefers; consequently the sentence cited in Paragraph 3 makes no sense. Further, it implies that "even the slightest amount of duct leakage" is causal to the HH allegation. The allegation that any duct leakage is problematic establishes an impossible performance criterion. I know of no best practice duct construction in manufactured or site built housing that can achieve zero duct leakage – this home, however, comes close with 27 CFM@25 leakage.

With reference to the paragraph 4 sentence; my inspection verified that as shown in the (HHR 5-22-06) Figure 12 photo, the ventilation system is performing as designed. No evidence to the contrary is provided by HH.

Report Issue 11 (Pg. 6, Figure 10 and 11)
Figure 8, Figure 9 and discussion

Response 11

Figure 10 and 11 illustrate a *site built home*, with a crawlspace and a perimeter foundation. This in no way represents how a manufactured home is constructed or how a manufactured home works. For reasons unknown, Figure 10 deletes the ventilation system installed in the Murphy home. Further, Figure 10 represents a home that has more duct leakage than it delivers in supply air. Whereas the Murphy home has been documented to have only very minor duct leakage.

Manufactured homes have a bottom plastic sheathing that acts as the air pressure boundary; materials inside the pressure boundary are considered to be inside the home. Furthermore, the fresh air ventilation system requirements of the HUD-Code are unrelated to possible duct leakage. Fresh air ventilation is intended only to provide fresh air, not to counterbalance duct leakage as is implied in the HH arguments.

Report Issue 12 (Pg. 8, Paragraph 1)
Fungal Sample Report.

Response 12

The sampling protocol and the interpretation of the air sampling results are flawed.

- All of the air sampling locations in the home were conducted within the wall cavity– not the air inside the living area.
- The method used to select sample sites ensured that the worst possible sites would be sampled and represented as the condition of the whole building. Using the sampling methodology in this report, an incident of moisture intrusion that resulted in an area of mold the size of a slice of bread would (incorrectly) be characterized to represent total wall failure.
- HH collected wall cavity samples at three sites in the exterior wall. The site where the highest elevated mold concentration was identified by the (HHR 5-22-06) report was located next to the front door– which is located directly opposite of an exterior light that was not properly sealed during setup. The second site that had an elevated reading was in the master bathroom, a location that had a known water flooding event in the past, as well

as moisture intrusion due to the unusual railroad tie landscaping. These factors alone may explain local fungal amplification in the two wall cavities.

- The lab analysis on the living room sample gave a total sample count of 1,266,667 per cubic meter, indicating “high level contamination”. Physical inspection of the site during (MS 10-24-07) did not reveal any visible signs of fungal activity, staining or structural damage. The physical observation for this cavity location was Condition 1—normal fungal ecology.
- There was no sample taken from air within the living area of the home. It should be expected that the living area has no amplification of mold related to the wall cavity,
- Finally, it is known that bulk, surface, and within-wall cavity measurement for molds cannot be used to assess occupant exposure.⁴⁵

The typical Healthy Homes report attempts to compare outside “free outside air samples” with air samples gathered from within a wall cavity - this is an invalid control for comparison – any conclusions from this comparison are meaningless. Outside air samples should only be compared with samples that have been collected using identical methods – not with air samples collected from within wall cavities. Wall cavity samples for investigation should be compared to samples collected from other similar wall cavity sites used as controls. Otherwise, the analysis is the same as attempting to compare “apples and oranges.”

The sample is compromised when the insulation is disturbed by “pushing the insulation away from the gypsum board” as described in the wall cavity mold collection protocol described in a companion report by Healthy Homes⁴⁶. This sampling protocol lacks merit and is apparently fabricated by Healthy Homes and is not described in any lab sampling guidelines nor is the Healthy Homes testing protocol or their selection of control validated by peer review from Industrial Hygienists or similar professionals. Disturbing the insulation constitutes an aggressive sampling technique.

The typical Healthy Homes report promotes the argument that because the ratio of Penicillium/Apergillus is higher within the wall cavity samples compared to outside samples that this indicates that there is mold growth. Mold populations in the outside air change dramatically over a short period of time; whereas, samples collected within a wall represent an average of all air particles that have accumulated since the wall was built. There is no meaningful interpretation to be gained by comparing these mold population distributions from different ecology environments.

⁴⁵ The medical effects of mold exposure, Bush RK, Portnoy JM, Saxon A, Terr AI, Wood RA, The Journal of Allergy and Clinical Immunology- 2006 02 (Vol. 117, Issue 2) Conclusions: Air Sampling of both indoor and outdoor air for mold...can be useful in certain clinical conditions, but it has many shortcomings. Bulk, surface, and within-wall cavity measurement for molds ... cannot be used to assess (occupant) exposure.

⁴⁶ The effects of a vapor barrier on a cooled wall in the hot, Humid Climate, A collection and Comparison of air sampling, by Healthy Homes of Louisiana, LLC, no date.

mSolve, Building Science Services

Appendix C - Comments on Healthy Homes' expert report

Subject Report: "Follow up inspection of the Murphy family home" By Bobby Parks of Healthy Homes of Louisiana, site inspection By Bobby Parks of Healthy Homes of Louisiana, LLC, for Lance Gould of Beasley, Allen, Crow, Methinks, Portis & Miles, P.C, Montgomery, AL 36104 No report date, site visit indicated as October 26, 2007 (HHR 10-26-07).

by Francis Conlin, mSolve Building Science Services, Professional Engineer, IAQA Certified Mold Remediator and Building Science Specialist

Summary:

Bulk sampling conducted in the follow up report does not indicate "mold contamination" as is alleged. No indication of mold growth is possible from this type of report.

Level of contamination is a biased terminology used by the HH lab. One spore would apparently show up as "Light Contamination" in the Galston lab report. There is no way to distinguish the Galston lab subjective description with normal fungal ecology as described in the IICRC S520.

On my (MS 12-4-07) inspection, additional samples were gathered from the wall cavities and were evaluated separately by Keith E. Leese, REHS, WLR, LRC Indoor Testing & Research. The LRC findings that (except for documented historic flood areas) these walls represent normal fungal ecology is summarized in a separate report.

Appendix D – Selected demonstrative images

